

Keemia lahtise võistluse ülesannete lahendused

Noorem rühm (9. ja 10. klass)

16. november 2002. a.

1. 1) $2\text{Na} + \text{O}_2 = \text{Na}_2\text{O}_2$
- 2) $2\text{Na} + \text{Na}_2\text{O}_2 = 2\text{Na}_2\text{O}$
- 3) $2\text{Na} + \text{I}_2 = 2\text{NaI}$
- 4) $2\text{NaI} + \text{Cl}_2 = 2\text{NaCl} + \text{I}_2$
- 5) $2\text{NaCl} = 2\text{Na} + \text{Cl}_2$ (sulatatud soola elektrolüüs)
- 6) $\text{Na}_2\text{CO}_3 + 2\text{HCl} = 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2\uparrow$; või $\text{Na}_2\text{CO}_3 + \text{CaCl}_2 = 2\text{NaCl} + \text{CaCO}_3\downarrow$;
- 7) $4\text{Na} + 2\text{CO}_2 + \text{O}_2 = 2\text{Na}_2\text{CO}_3$
- 8) $2\text{Na} + 2\text{H}_2\text{O} = 2\text{NaOH} + \text{H}_2$
- 9) $2\text{Na} + \text{S} = \text{Na}_2\text{S}$

2. a) Gaaside tihedused suhtuvad nagu nende molaarmassid.

Gaas **B** on lämmastik (28 g/mol).

$$M(\text{gaas D}) = 1 \cdot 28 \text{ g/mol} = \mathbf{28 \text{ g/mol}}$$

$$M(\text{gaas F}) = 3,54 \cdot 28 \text{ g/mol} = \mathbf{99 \text{ g/mol}}$$

$$M(\text{gaas E}) = 99 \text{ g/mol} - 28 \text{ g/mol} = \mathbf{71 \text{ g/mol}}$$

- b) **X** - C, süsinik

A – O₂, hapnik

B – N₂, lämmastik

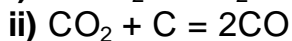
C – CO₂, süsinikdioksiid

D – CO, süsinikmonooksiid

E – Cl₂, kloor

F – COCl₂, fosgeen

- c) i) $\text{C} + \text{O}_2 = \text{CO}_2$



3. a) ask.hape \Leftrightarrow 2NaOH

$$n(\text{ask.hape}) = \frac{1}{2} \cdot 0,01600 \text{ dm}^3 \cdot 0,125 \text{ mol/dm}^3 = 0,00100 \text{ mol} = \mathbf{1,00 \times 10^{-3} \text{ mol}}$$

$$\text{b) } m(\text{värske petersell}) = 15,93 \text{ g} \cdot 0,800 \cdot \frac{1}{0,181} = 70,4 \text{ g}$$

$$m(\text{ask.hape}) = 70,4 \text{ g} \cdot 0,00250 = \mathbf{0,176 \text{ g}}$$

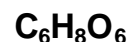
$$\text{c) } M(\text{ask.hape}) = \frac{0,176 \text{ g}}{0,00100 \text{ mol}} = \mathbf{176 \text{ g/mol}}$$

$$\text{d) } n(\text{H}) = 176 \text{ g} \cdot 0,0455 \cdot \frac{1 \text{ mol}}{1,008 \text{ g}} = 8 \text{ mol}$$

$$n(\text{C}) = 176 \text{ g} \cdot 0,4091 \cdot \frac{1 \text{ mol}}{12 \text{ g}} = 6 \text{ mol}$$

$$\%(\text{O}) = 100 - 40,91 - 4,55 = 54,54$$

$$n(\text{O}) = 176 \text{ g} \cdot 0,5454 \cdot \frac{1 \text{ mol}}{16 \text{ g}} = 6 \text{ mol}$$



4. a) $\text{NaNO}_3 + \text{KCl} = \text{KNO}_3 + \text{NaCl}$

$$\text{b) } n(\text{NaNO}_3) = 10,04 \text{ g} \cdot \frac{1 \text{ mol}}{85,0 \text{ g}} = 0,118 \text{ mol}$$

$$n(\text{KCl}) = 8,50 \text{ g} \cdot \frac{1 \text{ mol}}{74,6 \text{ g}} = 0,1139 \text{ mol} \approx 0,114 \text{ mol}$$

Seega saab tekkida

$$m(\text{KNO}_3) = \frac{1}{1} \cdot 0,1139 \text{ mol} \cdot 101,1 \text{ g/mol} = \mathbf{11,5 \text{ g}}$$

$$m(\text{NaCl}) = \frac{1}{1} \cdot 0,1139 \text{ mol} \cdot 58,5 \text{ g/mol} = \mathbf{6,66 \text{ g}}$$

c) $25,0 \text{ dm}^3$ vees lahustub 4 korda vähem, kui on lahustuvus. Seega

$$m(\text{NaNO}_3, \text{ lahuses}) = 21,9 \text{ g};$$

$$m(\text{KCl, lahuses}) = 8,50 \text{ g};$$

$$m(\text{KNO}_3, \text{ lahuses}) = 7,88 \text{ g};$$

$$m(\text{NaCl, lahuses}) = 8,95 \text{ g}.$$

Ainsa ainenä on moodustunud KNO_3 mass suurem kui tema lahustuvus.

$$m(\text{KNO}_3, \text{ väljakristalliseeruv}) = 11,5 \text{ g} - 7,88 \text{ g} = \mathbf{3,6 \text{ g}}$$

$$\text{d) \% (saagis)} = \frac{3,6 \text{ g}}{11,5 \text{ g}} \cdot 100 = \mathbf{31}$$

5. a) $M(\text{H}_2) = 2,016 \text{ g/mol}$

$$V_m(\text{H}_2) = 22,4 \text{ dm}^3/\text{mol}$$

$$r(\text{H}_2) = 2,016 \text{ g/mol} \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 0,0900 \text{ g/dm}^3 = \mathbf{9,00 \times 10^{-2} \text{ g/dm}^3}$$

b) $\rho(\text{H}_2) = 9,00 \cdot 10^{-2} \text{ g/dm}^3 \cdot 1 \text{ dm}^3/1000 \text{ cm}^3 = 9,00 \cdot 10^{-5} \text{ g/cm}^3$

$$r(\text{Li}) = 9,00 \cdot 10^{-5} \text{ g/cm}^3 \cdot 5,93 \cdot 10^3 = 0,5337 \text{ g/cm}^3 \approx \mathbf{0,534 \text{ g/cm}^3}$$

c) $1 \text{ dm}^3 \cdot \frac{1000 \text{ cm}^3}{1 \text{ dm}^3} = 1000 \text{ cm}^3$

$$m(\text{Li, } 1 \text{ dm}^3) = 1000 \text{ cm}^3 \cdot 0,534 \text{ g/cm}^3 = 534 \text{ g}$$

$$n(\text{Li, } 1 \text{ dm}^3) = 534 \text{ g} \cdot \frac{1 \text{ mol}}{6,941 \text{ g}} = \mathbf{76,9 \text{ mol}}$$

$$c(\text{Li}) = 76,9 \text{ mol/dm}^3$$

6. a) $\text{C}_{27}\text{H}_{17}\text{Cl}_2\text{NO}_{11}$

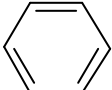
b) i) alkohol – CH_3OH , metanool

ketoon – H_3CCOCH_3 , propaan-2-oon

eeter – CH_3OCH_3 , dimetüüleeter

karboksüülhape – HCOOH , metaanhape

alküün – $\text{HC}\equiv\text{CH}$, etüün

areen – , benseen

primaarne amiin: CH_3NH_2 , metüülamiin

ii) Antud fluorestseiini derivaat kuulub järgmistesse aineklassidesse:

ketoon, eeter, karboksüülhape, areen.

c) 1000 krooni eest saab $\frac{1000 \text{ EEK}}{700000 \text{ EEK/g}} = 1,43 \text{ mg}$ ainet $\sim \mathbf{1 \text{ mg}}$

$$M_r(\text{aine}) = 27 \cdot 12 + 17 + 2 \cdot 35,5 + 14 + 11 \cdot 16 = 602$$

$$n(\text{aine}) = \frac{1,43 \cdot 10^{-3} \text{ g}}{602 \text{ g/mol}} = 2,38 \cdot 10^{-6} \text{ mol} \sim \mathbf{2 \times 10^{-6} \text{ mol}}$$